THE NATIONAL ACADEMIES
Advisers to the Nation on Science, Engineering, and Medicine

Board on Physics and Astronomy (BPA)
Solid State Sciences Committee (SSSC)
DMR-0137236 and DMR-0203294

Highlights

Two research assessments are currently under way under the auspices of the Board on Physics and Astronomy and the Solid State Sciences Committee and a third is just starting (Fall, 2004). These studies identify opportunities for progress in materials research that will deepen our understanding of our world and benefit society through applications of new knowledge.

• Opportunities in high magnetic field science

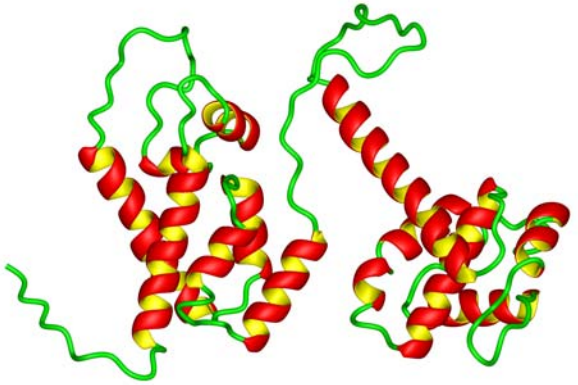
A February 2004 interim report stated, "Advances both in magnet design and in our fundamental understanding of magnetism are certain to have beneficial impacts on a host of technologies critical to the national welfare."

• Small and mid-sized multi-user facilities in materials research

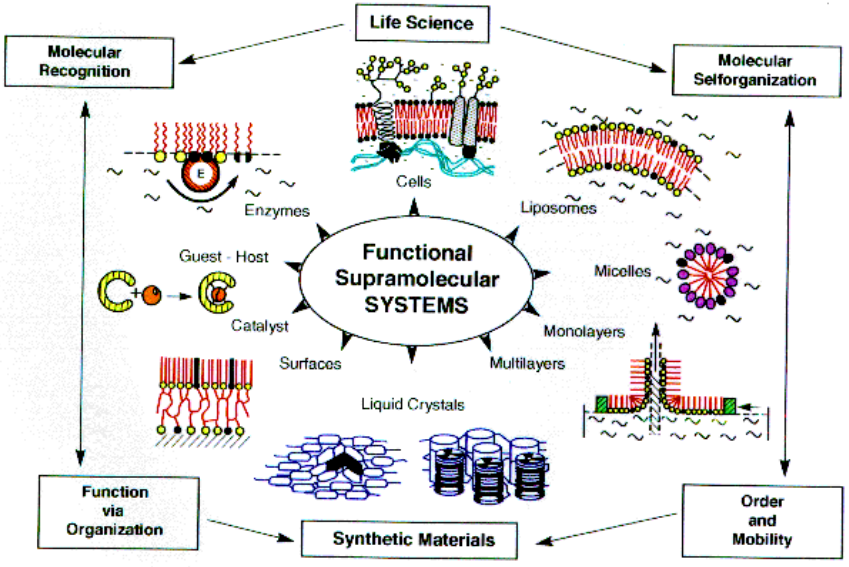
A March 2004 interim report stated, "There are significant opportunities for accelerating scientific advances in materials and nanotechnology research by invigorating such facilities and allocating their resources to best effect."

• Biomolecular materials and processes –

A new study of the science at the interface of biology, condensed-matter physics, and materials science. This project will update and extend an assessment of this field published in 1996.



Ribbon representation of the molecular structure of a 283-amino-acid portion of a polyprotein encoded by the HIV-1 genome, determined by nuclear magnetic resonance (NMR). This structure illustrates both the complexity and the biomedical relevance of problems addressable by modern NMR, as enabled by high magnetic fields and ancillary technology.



High-magnetic field science and technology. Advances in magnet technology in the last few decades have yielded great scientific progress, and the technology appears to be ripe for further progress. The Board on Physics and Astronomy and the Solid State Sciences Committee initiated a National Research Council study to provide an assessment the current state and future prospects for high-magnetic-field science, technology, and instrumentation in the United States. The assessment takes into account the international context and trends. Promising multi-disciplinary areas for research and development will be identified. The study will review major initiatives in the construction of high-field magnets and set priorities for the coming decade. The study will be carried out in the context of the science outlook for other materials characterization techniques, including neutron scattering, x-ray studies and ultrasound. An interim report (quoted above) was released early in 2004. The study is expected to be completed by December, 2004.

Smaller materials-research facilities. The Board on Physics and Astronomy and the Solid State Sciences Committee recently formed a committee to carry out review the state of smaller multi-user facilities within the materials research complex in the United States. These facilities play a crucial role in materials research. They successful operation in a university setting presents a number of problems. The committee is considering ways to optimize the use of existing resources, including strategies for providing research services more efficiently such as the consolidation of smaller facilities into regional centers. The elements of this study include: a definition of smaller facilities and their role in the scientific complex; data collection on and an analysis of the usage, structure and cost/effectiveness of facilities currently in use; an analysis of various models for facility operation, their effectiveness and appropriate metrics for their success; an assessment of the opportunities for instrumentation research in the context of facilities, including the impact of these on science and industry and optimal location of instrumentation development activities; the educational role played by smaller facilities; the optimizing of investment in smaller facilities, including the re-allocation of existing resources; and the development of long-range models for the support of regional centers. The committee has already found significant opportunities for improving the performance of such facilities and foresees a positive impact on progress in materials research from action on these opportunities.

Biomolecular materials and processes. Processes for the synthesis of molecules and materials in biological systems may be able to be adapted to produce new engineered materials with remarkable properties and functions. This idea was developed in an assessment entitled *Biomolecular Self-Assembing Materials: Scientific and Technological Frontiers* (BPA and SSSC, 1996). The field has developed considerably since that time, with particular progress in nano-materials, and a new assessment of the opportunities in this area will soon be launched by the Board on Physics and Astronomy and the Solid State Sciences Committee.

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Education & Outreach

The Committee on Smaller Facilities held a town meeting at the American Physical Society March meeting in Montreal and at the spring Materials Research Society meeting in San Francisco to share its interim report with the community and to collect feedback.

At its recent semiannual meeting, the SSSC heard testimony from former American Physical Society president Myriam Sarachik and White House Office of Science and Technology Policy representative Michael Holland.

2004 MRS SPRING MEETING
APRIL12-16 • SAN FRANCISCO, CA USA

APS March Meeting 2004
March 22-26 • Montreal, Canada

Committee on Smaller Facilities chair Robert Sinclair (Stanford) discusses the committee's interim report with Materials Research Society conference attendees.

In its March 2004 interim report, the committee found that "these facilities also have an important role in the education of future industrial scientists and engineers."

The Board on Physics and Astronomy maintains a web site that is actively and frequently visited. It contains pages for committees such as the Solid State Sciences Committee and the Committee on High Magnetic Field Science, which received 39 letters from the community through its webpage.